VARIATION IN STRUCTURE OF LIGULA OF TANYPODINAE LARVAE (DIPTERA: CHIRONOMIDAE)[1]

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ABSTRACT: Variations in the structure of the ligula of Tanypodinae larvae (Diptera: Chironomidae) were found in six of nine genera examined. About 3 percent of the 2370 larvae examined were considered abnormal, possessing either fewer or greater numbers of teeth than typically found, or teeth that were bifid, curved, or otherwise asymmetrical.

Findings indicate that taxonomic keys which rely primarily on the number of ligula teeth should be used with caution. Basic shape and color of the ligula, besides number of teeth, are important characteristics; combinations of other characters are provided here to aid in identifying certain genera.

The number, shape, and color of teeth on the ligula of Tanypodinae larvae have been used as key characters in separating tribes and genera (Beck 1976; Mason 1973; Roback 1978, 1980; Webb and Brigham 1982). We have found that the ligula is a variable structure in certain species, especially in regard to the number of teeth, and this variation can lead to mistaken determinations using present keys which overemphasize ligula morphology. Some larvae simply cannot be keyed to ligula characteristics alone.

We examined nine genera and found atypical ligulas in six of them. For each genus in which we have observed abnormal ligulas, we describe and illustrate the major types of variations and give a combination of characters by which the larvae may be reliably identified. All specimens examined are from northern Alabama. The drawings were made by tracing photographs; the paraglossae were included since they can be useful in confirming identifications.

Ablabesmyia

The ligula typically bears five black teeth, the tips of which are often translucent; the median tooth is shorter than the first lateral teeth in most species. The ligula of *A. annulata* (Say) is unusual in that the median tooth is at least as long as the first laterals and the apices of these three teeth are truncate (Figure 1). One larva from Alabama (25 examined) has a ligula with an extra lateral tooth, for a total of six teeth (Figure 2). *Ablabesmyia* larvae may be recognized by the presence of more than one basal palpal segment, and most species have one or two dark claws on the anal prolegs.

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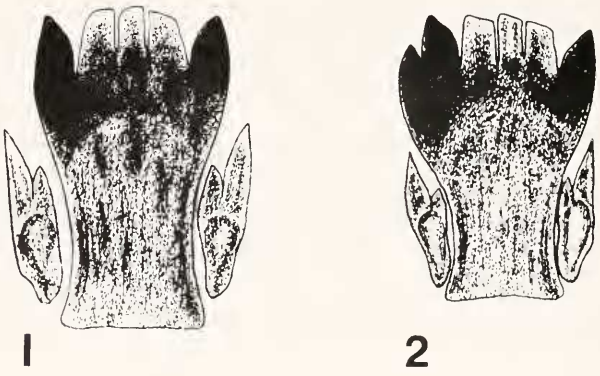
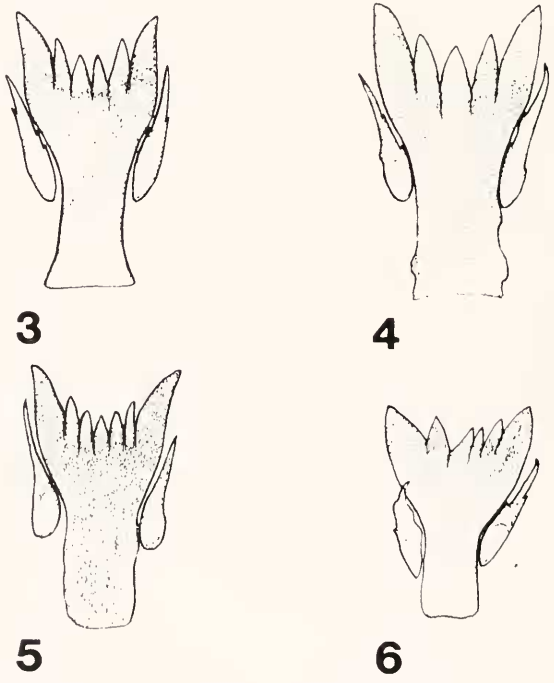


Figures 1-2. Typical ligula (1) and abnormal ligula (2) of *Ablabesmyia annulata.*

Clinotanypus

The typical *Clinotanypus* ligula has six clear amber teeth (Figure 3). Several *C. pinguis* (Loew) larvae we observed had five or seven teeth (Figures 4 and 5), while another larva had a ligula with six asymmetrical teeth (Figure 6). A total of 9 larvae (3.16 percent) out of the 285 larvae examined possessed atypical ligulas.



Figures 3-6. Typical ligula (3) and abnormal ligulas (4-6) of *Clinotanypus pinguis.*

Because of the variations in the number of teeth between specimens of the same species, the number of ligula teeth is not a totally reliable diagnostic character. In addition, other genera may have the same number of teeth as *Clinotanypus*. Roback (1974) reported *Colelotanypus concinnus* (Coquillett) larvae with six to eight teeth (the usual number of ligula teeth for this genus is seven).

Characters that distinguish *Clinotanypus* larvae from those closely related include: (1) head about 1-1/2 times as long as wide, (2) antennae about 3/4 as long as head, and (3) mandibles hook-like. In addition, a small, lateral spur-like process between the second and third thoracic segments of *Coelotanypus* larvae will help to differentiate them from *Clinotanypus*.

Djalmabatista

The typical ligula of the only North American species, *D. pulcher* (Johannsen), has four black teeth (Figure 7) (See Roback and Tennessen 1978). We have found a high degree of variation in the number and shape of teeth in several populations. Of 1545 larvae examined, 50 (3.24 percent) were atypical. The number of teeth varied from three to six; other configurations included asymmetrical, bifid, and curved teeth (Figures 8-16). The most common abnormal type of ligula had five symmetrical teeth (Figure 12) resembling the *Procladius* ligula and larvae of two South American species of *Djalmabatista* (Roback 1980). Larvae with three teeth cannot be keyed.

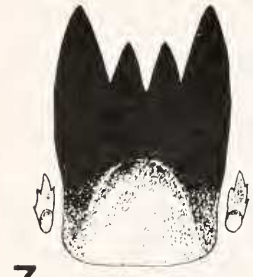
Other diagnostic characters for the genus which should be used in addition to ligula characteristics for accurate taxonomic identification are: (1) blade of antennal segment 1 much longer than combined length of antennal segments 2-4 and (2) mandible with bilobed inner tooth (Roback 1980).

Larsia

The ligula typically has five dark brown teeth (Figure 17). Out of 110 larva examined, 1 had 6 teeth (Figure 18). The genus is characterized by the combination of: (1) teeth of ligula in concave configuration, with first laterals pointed anteriorly; (2) preanal papillae less than five times as long as wide; and (3) antennas yellow, antennal ratio $\pm$ 4.0.

Procladius

The typical ligula of both subgenera (*Psilotanypus* and *Procladius)* has five black teeth, the outer laterals longest, the median shortest (Figures 19 and 24). We examined 223 larvae of *P.* (*Psilotanypus*) *bellus* (Loew) and observed that 10, or 4.48 percent, had atypically shaped ligulas. Variations included four teeth (Figure 20), five asymmetrical teeth (Figures 21 and 22), and six or seven teeth (Figure 23).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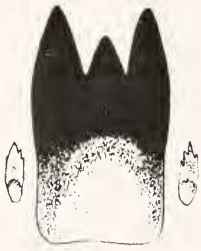
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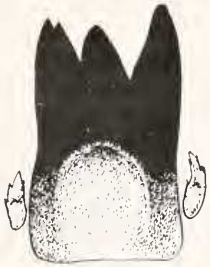
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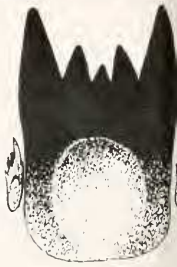
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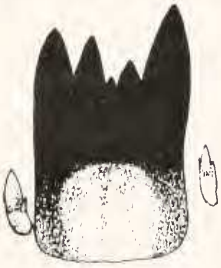
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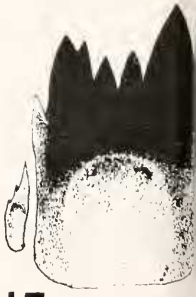
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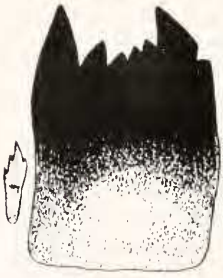
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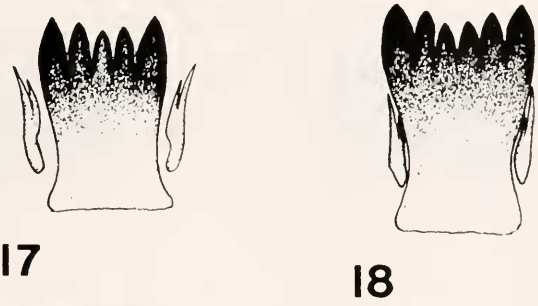
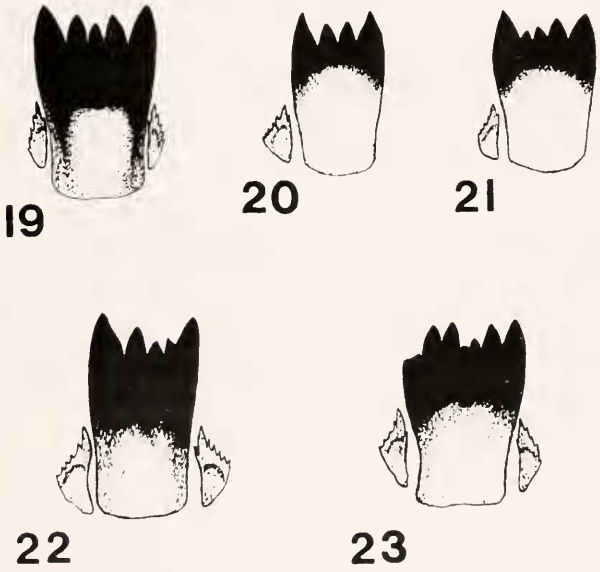
Figures 7-16. Typical ligula (7) and abnormal ligulas (8-16) of *Djalmabatista pulcher*.



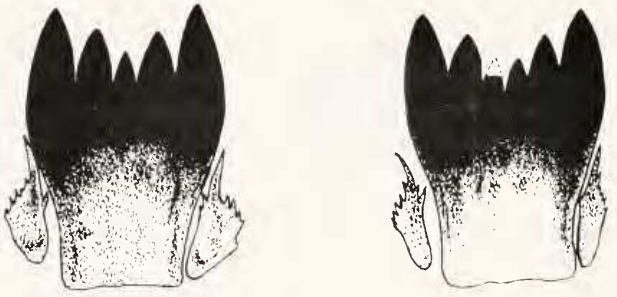
Figures 17-18. Typical ligula (17) and abnormal ligula (18) of *Larsia* sp.



Figures 19-23. Typical ligula (19) and abnormal ligulas (20-23) of *Procladius bellus.*

A reliable combination of other characteristics for *P. bellus* includes: (1) blade of antennal segment 2 subequal in length to antennal segments 2-4, (2) single tooth on inner margin of mandible, (3) hypopharyngeal pecten with 4-8 teeth, (4) smallest one or two claws of posterior prolegs usually toothed, and (5) ligula of instar IV 61-87 μ (based on Roback 1980).

One specimen out of fifty-eight *P. (Procladius) sublettei* Roback larvae examined had an aberrant ligula, with six teeth (Figure 25). Part of one of the median teeth on this specimen was broken off. Otherwise, the specimen resembles an aberrant larvae reported by Roback (1980, Figure 25).

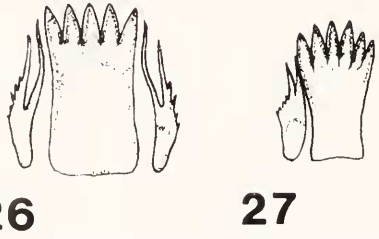


Figures 24-25. Typical ligula (24) and abnormal ligula (25) of *Procladius sublettei.*

Larvae of the subgenus *Procladius* differ little among the species. Roback (1980) offered a provisional key based on size differences. As a group, they differ from *Psilotanypus* in their larger size and the longer apical tooth of the paraglossae (compare Figures 19 and 24).

Tanypus

The typical ligula is pale to light brown, with five teeth; the median tooth and first lateral teeth are as long as or longer than the outer laterals (Figure 26). We have 1 specimen of *T. punctipennis* Meigen with 6 teeth (Figure 27); we examined 12 specimens. The genus is recognizable by the following combination of characteristics: (1) the presence of dorsomental teeth, (2) ligula pale, teeth with tips in convex or straight configuration, (3) body with conspicuous lateral hair fringe, an (4) mandibles thick and bulging in basal three-fourths of their length.



Figures 26-27. Typical ligula (26) and abnormal ligula (27) of *Tanypus punctipennis.*

DISCUSSION

Examination of over 2370 Tanypodinae larvae from northern Alabama

revealed that slightly over 3 percent possessed an abnormal ligula, with either more or fewer teeth than dictated for the taxa, or with some type of asymmetry. Although the incidence of ligular abnormalties is low, it shows that most keys rely too heavily on the ligula as a character for distinguishing genera.

The majority of larvae examined were fourth instar, although a few abnormalities were found in second and third instar larvae. Our data indicate that the ligula within the Procladiini is more variable than within the Pentaneurini. For example, some monthly samples of *Djalmabatista pulcher* consisted of over 6 percent abnormal larvae.

Hamilton and Saether (1971) observed deformed chironomid larvae in Lake Erie and in two lakes in British Columbia. Approximately 1 percent of the larvae were affected, the most common deformity being an extremely thickened integument; a few had deformed mouthparts. An analysis of the distribution of deformed larvae in these lakes showed that they occurred in areas receiving industrial discharge or agricultural runoff.

The majority of larvae we examined were from two man-made lakes and three ponds formed in pits from which coal had been stripped in Marion County, Alabama. The percentage of ligula deformities was slightly higher in the combined strip-mine pond samples (Table 1), but was not significantly different that the percentages found in the man-made lakes. Whether certain environmental variables are causative agents during larval development is unknown.

Table 1. Number of larvae with a deformed ligula from three locations in Marion County, Alabama. Numbers in parentheses are numbers of larvae examined.

	Marion County Lake	Strip-Mine Ponds	Buttahatchee Lake
Ablabesmyia	1 (29)	0 (50)	0 (22)
Clinotanypus	1 (35)	4 (73)	4 (177)
Djalmabatista	10 (547)	40 (1014)	0 (2)
Larsia	0 (4)	1 (99)	0 (7)
Procladius	0 (24)	1 (36)	10 (240)
Tanypus	0 (0)	0 (2)	1 (12)
Totals	12 (639)	46 (1274)	15 (460)
	1.88%	3.61%	3.26%

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This volume deals with the sub-families Cliterllariinae, Hermetiinae, Pachygasterinae, plus bibliography.

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Fourteen papers on mechanics regulating seasonal adaptation, life cycle polymorphism, and evolution of life cycle strategies.

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